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Enabling Conceptual Learning to Prepare Students for the New World of Nutrition Communication

A Peer Review of Teaching
Benchmark Portfolio

**NUTR251: Nutrition Through
the Life Cycle**

2021

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Abstract:

During the last decades, the flow of nutrition information between nutrition professionals and consumer has changed profoundly. Newest scientific findings are freely available from public data bases and often make it prematurely into the media and social media. Therefore, students need to require a precise knowledge of nutrition concepts, be able to explain the concepts to the consumer, and apply those concepts to eating decisions. Many students have not made the transition from memorizing individual facts to conceptual learning. Students will need appropriate learning tools and instructions to help them make this transition successfully.

The goal of this Peer Review of Teaching Portfolio is to explore how learning tools can contribute to conceptual learning.

The course explored in this portfolio is NUTR251 *Nutrition Through the Lifecycle*. Students learn how eating decision in all life stage can influence the development of chronic diseases and therefore the life expectancy and quality of life.

Learning tools employed to support the students' conceptual learning were multi-answer study quizzes, problem-solving activities, infographics, comprehension questions, and collaborative self-explanation.

Analysis of exam score development and student surveys showed that the combination of learning tools was effective in aiding conceptual learning. Exam grades improved almost a full letter grade. The students reported that the learning tools aided in improving their understanding and application of nutrition concepts. The student surveys also identified that two learning tools need fine tuning, infographics and collaborative self-explanation.

Overall, the course is on the right track. Future course design work will include adjustments to the learning tools and the evaluation how the conceptual learning is contributing to content retention.

Keywords: NUTR251 Nutrition Through the Life Cycle – Conceptual learning - Multi-answer study quizzes – problem-solving activities – infographics – comprehension questions – collaborative self-explanation

Enabling Conceptual Learning to Prepare Students for the New World of Nutrition Communication

A Peer Review of Teaching Benchmark Portfolio of NUTR251 Nutrition Through the Life Cycle

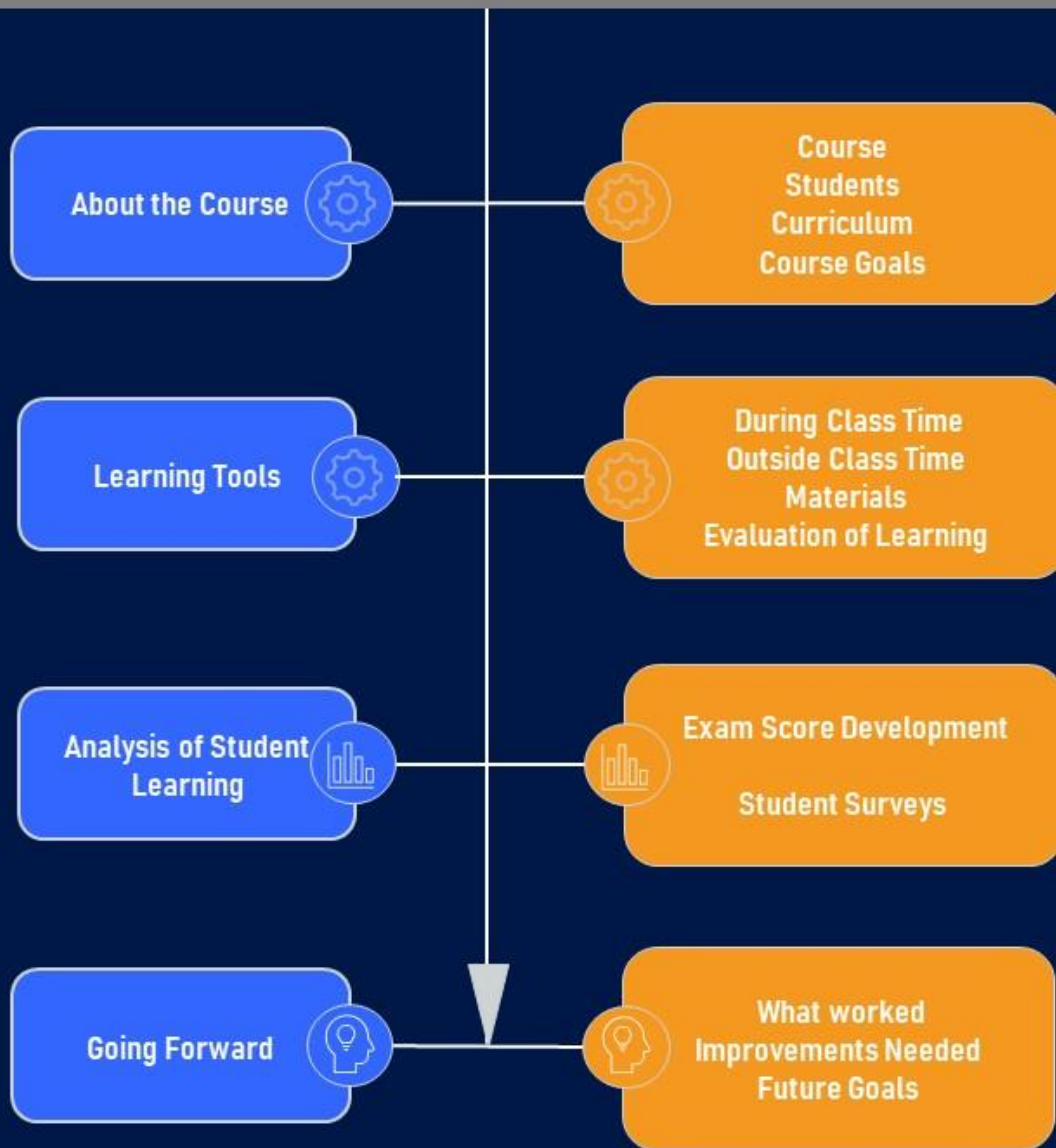


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1. About the Course

1.1 Introduction

I took this course myself decades ago and the idea how this course is taught never changed. For each life cycle stage students learn about the physiology, the corresponding nutrient recommendations, and common nutrition related diseases. Stages are introduced as separate occurrences and the main goal is the memorizing of the facts for each life stage.

In the past this made sense. Nutrition information was dispersed by a hierarchical system. Scientists evaluated the existing research and together with health professionals they developed recommendations and curriculum. Health professionals such as dietitians, nutritionists and physicians would disseminate this curated information via counseling, leaflets, TV, and print media.

The understanding of nutrition, health and longevity has changed profoundly since I took this course. Additionally, students come into the course pre-loaded with popular media nutrition information that is often incorrect. A successful course will correct the misinformation, deliver interesting content—competing with the PR machinery of nutrition influencers—and enable student learning that will prepare students for a professional work life.

When I took over this course in spring 2020 from a retiring faculty, I started out by lining up the course goals with the new paradigm promoted by the World Health Organization *Quality of life and healthy life expectancy depend on avoiding or delaying chronic diseases during life. Lifestyle choices during all life stages, especially the critical periods, prime the individual for the development of chronic diseases.*

Once I had decided on course goals, I started looking at textbooks and realized that the two textbooks that exist for the lifecycle nutrition course adhere to the old paradigm that humans move from one life stage to the next.

In addition, 50% of the content of textbook 1 targets advanced undergraduate students and post-graduation dietetics students. Textbook 2 is more a reader providing a general overview combined with a focus on societal issues. Both books were expensive ranging from \$160-200 and too expensive to assign as an occasional reading.

I decided to start from scratch. I developed the content for the course and started to compile an OER (open educational resource).

Students were involved in the course design from the beginning. In the spring 2020 course the students started the process of writing an OER by using my infographic style lecture slides and their class notes to collaboratively write their own textbook. Fall 2020 students edited the content from the previous semester and wrote a study guide.

During the entire time I encouraged the students to share their ideas and critique. Based on many conversations and discussions the course started to form. The content, learning goals and objectives, and the learning tools are in place. The format of the OER (open educational resource) has taken shape. NUTR251 Nutrition Through the Life Cycle developed into a modern, student centered course that is very different from the standard course as it is still taught at many nutrition departments.

The students and I are currently in uncharted territory and the peer review project seemed to be an excellent opportunity to reflect on course goals, course structure and course content. It will also allow me to evaluate the learning strategies I employ and assess how well students meet the course goals.

1.2 The Students

The course has space for 60 students. Currently, students enrolled in this course are mostly majors from the department of nutrition and health sciences. The future field of employment for these students is broad:

- **Community Health and Wellness:** Prepares students to plan, deliver, manage, and evaluate fitness, health, and wellness programs in a variety of settings with a focus on all aspects of wellness. The option will assist in preparing students to take the Certified Health Educator Specialist (CHES) examination.
- **Nutrition, Exercise, and Health Sciences:** Prepares students to plan, deliver, manage, and evaluate fitness, health, and wellness programs in a variety of settings with a focus on exercise and physical activity. The option will also assist in preparing students for nationally recognized certification examinations related to exercise, and strength and conditioning. NUTR251 is an elective.
- **Nutrition Science:** This option will prepare students who are interested in a research career and will prepare students applying for professional programs in medicine. At this point the course is not required for this option.

In addition, since this course is an elective, students are taking the course at various stages in their undergraduate career. In spring 2020 students were 45% seniors, 40% juniors, 12% sophomores and 2 % freshmen. The range of knowledge students bring into this course causes issues when designing course content.

The student population will become even more diverse in the future. The plan is to expand this course to satisfy requirements for future family and consumer science educators and pre-health students.

1.3 The Course Within the Nutrition and Health Sciences Curriculum

The pre-requisite for this course is the completion of NUTR250 *Human Nutrition and Metabolism*. Students are expected to bring the following foundational knowledge to NUTR251:

- Digestion, absorption, and metabolism
- Nutrient chemistry, nutrient metabolism, and food sources of nutrients
- Common chronic diseases and the relationship to nutrient intake

Combined knowledge of NUTR250 and NUTR251 is the foundational knowledge for the ACE 2 science communication course NUTR302 *Health Messaging: Science, Media and the Consumer*, 450/452 *Medical Nutrition Therapy I/II*, and the capstone course NUTR455 *Advanced Nutrition*.

Many students will work in the health field after graduation. Some will work as health care professionals such as dietitians, physicians, physician assistants, nurses, physical or occupational therapists, and trainers. Others will work in community or corporate wellness planning. Knowledge and skills from NUTR251 will allow both groups to better understand the needs of their clients and refrain from a *one recommendation fits all* approach.

Working in the health field today is complicated by the spread of misinformation and exaggerated information in the media. NUTR251 addresses foundational knowledge, but also addresses areas that are commonly affected by this misinformation. This results in introducing content that was traditionally considered as reserved for advanced undergraduate and graduate students.

1.4 The Course Goals

Following the main paradigm of this course, *Quality of life and healthy life expectancy depend on avoiding or delaying chronic diseases during life. Lifestyle choices during all life stages of life, especially the critical periods, prime the individual for the development of chronic diseases*, I decided on the following course goals.

Upon completion of this course the students will be able to:

1. Understand and retrieve physiological changes during life stages and explain how they alter dietary needs throughout life.
2. Recognize the additive effect of eating decisions and malnutrition during all life-stages on health, chronic diseases, longevity, and life quality.
3. Apply physiological, food, and nutrient knowledge to evaluate the adequacy of common eating patterns during life stages.
4. Explain the rationale for select public nutrition interventions.
5. Identify some of the socio-economic and cultural barriers to meet nutritional needs.

These major goals expand into all six modules. Measurable learning outcomes are listed for each course module.

The course starts out introducing the current scientific knowledge how obesity contributes to the development of three major chronic diseases, high blood pressure, type 2 diabetes, and cardiovascular disease. During the following 5 modules students follow the lifecycle starting before conception. They learn about physiological changes and how eating decisions, especially during sensitive periods, can delay or accelerate the development of chronic diseases. The course closes with the juxtaposition of the high life quality of healthy and fit aging adults versus the low quality of life in frail individuals.

There are three major challenges teaching this course:

1. The course builds on the foundational knowledge from NUTR250 *Human Nutrition and Metabolism*. If students retain very little content from NUTR250 the lifecycle nutrition course will become very overwhelming. On the other hand, the course presents the opportunity to

deepen retention of foundational nutrition knowledge. For some juniors and seniors the NUTR250 course is already 1 – 3 years in the past.

2. Students are used to memorizing individual facts, but the paradigm of this course will require conceptual learning. Conversations I had with students after the first exam in spring and fall 2020 have brought up the issue that students do not know how to learn and study conceptually. Especially lower achieving students have problems deciding between concepts and individual facts. This makes studying and learning overwhelming. Students feel that they studied a lot but are ill prepared for the exam.
3. Since the NUTR251 provides foundational nutrition knowledge for advanced nutrition courses and future career, retention of the material is essential. Cognitive research shows that conceptual learning and engagement with course material enhances retention.

1.5 Goals for the Benchmark Portfolio

Courses such as NUTR251 will require on one hand precise understanding and application of concepts, the connection to the overarching paradigms, but also memorization of individual facts.

After explaining my reasons to teach the course conceptually one student observed “I understand what you want me to do, but I have no idea how to study that way. All my study approaches aim at memorizing.”

If students are not able to make this transition from solely memorizing to conceptual learning they tend to end up with an array of disjointed facts and consequently will not meet the course goals. Since disjointed facts are harder to retain long-term, students will struggle in following courses as well.

Therefore, the goals for this course portfolio are:

Goal 1: Enable students to distinguish between concepts and individual facts to enable conceptual learning.

Goal 2: Evaluate the efficiency of employed learning tools in aiding conceptual learning (student perception).

2. The Learning Tools

2.1 Learning Strategies During Class Time

Many other nutrition programs teach *Nutrition Through the Life Cycle* as a two-semester course, and this made it clear from the beginning that I am not able to teach every aspect of the subject. In consequence, I needed to set emphases and corresponding goals. This was informed by three thought processes:

- What knowledge and skills are essential for future health professionals?
- What soft skills are essential for future health professionals?
- What misinformation in the media related to life cycle nutrition are health professionals currently confronted with?

After identifying areas of emphasis, I developed a narrative for the progression of the course and assigned learning objectives to each chapter. During the first semester in spring 2020 I started out with in-class lectures interspersed with comprehension questions (not graded). After a couple of classes I started reserving 10 to 15 minutes of most classes for problem solving activities.

The first exam had a lower average score than I like to see. Conversations with students made it clear that the students tended to memorize disconnected, individual facts from the lecture slides and failed to work on the understanding of the major concepts. This is a common problem I encounter in other courses as well.

The fact focused learning also led to a feeling of being overwhelmed since students lost track of the concepts.

Both issues informed a rethinking of the class structure after the first exam. The general structure of the classes remained since students enjoyed the combination of lecture, comprehension questions and activities. I addressed the detected issues by tweaking this general structure.

- At the beginning of each chapter, I take a couple of minutes to expand on a flow chart of the module. I focus on the big idea of a module and the major concepts I introduce.
- After students reported that they like if a lecture visual aids summarize the concept, I morphed them throughout the spring and fall 2020 semester into **summarizing infographics**. I add animations to walk students step by step through the concept. Students can download a set of infographics for each lecture, and many add details during the class.
- Initially, I used the interspersed **questions during the lectures** to connect the course content back to the pre-requisite course, but I changed the questions to test comprehension of the concepts. This gives me the opportunity to explain misunderstanding.
- The 10-minute **problem-solving activities** challenge students to apply course content and to explain concepts in their own words. The activities are completed in small groups. After finishing the activity, I share a solution slide with the students. The course is planned for 60 students and only occasionally supported by a teaching assistant. This limits personal feedback or graded activities as teaching strategies.

In Fall 2020 I had a small class because this was the first time the course was offered in a fall semester. This gave me the opportunity to grade the activities which allowed me to write better instructions and anticipate issues. If time allows, I will spot read and give feedback to some activity results on a rotating basis. The activities receive attendance points for completion.

2.2 Learning Activities Outside of Class Time

These learning activities focus on conceptual learning and application of the content to nutrition practice. I employ three strategies:

- **Study quiz (10 points):** At the end of each unit students complete a study quiz. These quizzes have 10 question in a multi-answer format. Questions and answers are designed to test understanding of concepts. Students have three attempts per quiz. After the first attempt students are encouraged to re-study the concept they missed. The goal is to slow down and stimulate in depth learning. If the students are not able to solve a question after the second attempt, they are encouraged to discuss the question after class with me. Every motivated student should be able to finish those quizzes with an A.
- **Collaborative self-explanation:** Before each of the four exams I reserve one class to collaboratively start the preparation process for the exam. Students work in groups on a set of study guide questions using course Google Docs. The goal is to stimulate a self-explanation technique for better conceptual learning. If I encounter a general problem, I will start a brief chalk talk for the entire class. During the Covid-19 pandemic most students participate via zoom. I set up breakout rooms and allow the students to self-enroll. I will give feedback using the Google Doc comment function or visit with teams in their breakout room.
- **Yellow dig (~ 15 extra credit points per semester):** Many students tend to be anxious about failing exams. I encourage students to create a point cushion by participating in Yellow Dig discussions. Students can collect 1 extra credit point per week by either posting and briefly discussing a relating concept from another course, news item, or a scientific article. Students are required to describe briefly how the article relates to or expands current course content. Other students join the discussion expanding on the post.

2.3 Course Materials

Open Educational Resource:

When I took over this course in Fall 2019 and began to revise the course it became clear that neither of the two textbooks on the market would be effective for this specific group of students. In addition, both books are expensive. I felt that I cannot ask student to pay for an expensive book when they only need it for an occasional chapter.

I am currently in the process developing my own open educational resource. The collaboration involved the students from the spring and fall 2020 classes, my current teaching assistant, and undergraduate student workers. Talking to many students it became clear that a good OER needs to fulfill a few requirements.

- A reading should not be much longer than 30 minutes per class. Long readings will lead to skimming which counteracts conceptual learning. This lines up with studies identifying the maximal time span for focused learning as 30-minute bouts.
- Some students prefer a graphic summary of the concept they can add lecture notes to while others prefer a written text.
- Modern reading especially when completed online stimulates skipping sentences and paragraphs. Today, people tend to read only 20 - 30% of a given text and tend to read in an F-shape (increasing skipping and skimming after one or two paragraphs). If a textbook is written in a traditional format, students will miss a lot of information.
- Concepts should be clearly identifiable.
- Students tend to *finish* previous courses and do not transfer knowledge to subsequent courses.

Based on this feedback and observations an OER format evolved that starts out each chapter by listing all chapter concepts. This is followed by a review infographic of expected knowledge from the pre-requisite course (NUTR250 Human Nutrition and Metabolism).

Each concept is started with the summarizing infographic which is followed by explanatory text. At the end of each chapter knowledge expanding literature is offered.

The goal of this approach is to support conceptual learning and to enhance long-term memorization of essential nutrition knowledge. The OER went live in spring 2021.

Flow charts:

Courses such as Nutrition Through the Lifecycle balance accurate conceptual learning and fact memorization. Based on feedback from students in spring and fall semester 2020, the problem is that students are getting lost in the details. This problem affects predominantly lower achieving students. After identifying the issue, I started building flow charts into the course that allow students to track the course progress. Over time I would like to develop this into a collaborative student activity.

Collaborative completion of study questions using Google Docs:

Student self-explaining of concept has two purposes. Self-explanation is a proven study tool to enhance learning and retention of the student who writes the explanation. In addition, reading a concept explained by another student aids understanding. Student feedback so far supports this assumption.

In my experience developing effective approaches to explain a complicated concept to undergraduate students who have a range of knowledge is a process. Reading the student explanation of concepts helps me understand where my approach to lecturing and writing (OER) need to improve. Ultimately this helps me to break down concepts better increasing understanding.

2.4 Evaluating Knowledge and Progress

Over the years I became aware that:

- My course is just one of several courses students take in a semester.
- Most students need some flexibility to complete course work.
- Too much low-stakes testing generates the impression of overwhelming busy work.
- Too much testing—low-stakes and high-stakes—generates anxiety and a hunt for points. This hinders curiosity in the content.
- Too little testing shifts the student focus to other courses.

Based on this experience I try to find a good balance that keeps the student focus on my course and avoids busy work while allowing for moderate flexibility. The assessment of progress includes:

- Four high-stakes exams testing understanding and application of concepts to evaluate progress: 400 points
- Ten multi-answer study quizzes: 100 points
- Attendance points for the in-class activities: 50 points
- YellowDig as an opportunity to collect preemptively extra credit points to lower grade anxiety: 15 extra credit points.

Since conceptual learning tends to improve substantially throughout the course, I encourage students to retake the first exam at the end of the semester.

2.5 Link of Course Materials to Broader Curriculum

NUTR251 *Nutrition Through the Lifecycle* builds on NUTR250 Human Nutrition and Metabolism which introduces students to foundational knowledge in nutrition sciences. This is essential knowledge students working in the health field need to know long-term.

It cannot be expected that students will retain all NUTR250 course content after being exposed to it one time. I designed NUTR251 to encourage students to review many of those foundational concepts. This will increase long-term retention. The design of the lectures and the OER (open educational resource) is intended to meet this goal.

Most OER chapters start with a review infographic summarizing the content from NUTR250 that is essential to fully understand the chapter. This brief review is integrated into each class in an abbreviated version.

Secondly, NUTR251 *Nutrition Through the Life Cycle* will increase understanding of foundational nutrition knowledge. This is achieved by looking at the knowledge through the lens of lifecycle nutrition which is more nuanced and much more applied than the first contact students have with this knowledge in NUTR250. In-depth understanding and solidifying of knowledge are necessary for subsequent classes.

Focusing on understanding and applying concepts will suit students well in their future health careers. Health care provider need to be able to analyze a nutrition related situation and identify the appropriate

knowledge, concept, and solution. While those skills grow only with job experience, my choices of teaching tools try to set the foundation.

3. Analysis of Student Learning

3.1 Enable students to distinguish between concepts and individual facts to enhance conceptual learning

3.1.1 Exam scores improved throughout the semester

All exam questions are designed to test understanding or application of concepts. Students will not be able to look up answers on lecture slides or the open educational resource. Instead, students will need to have a good understanding of the content to answer questions correctly. Due to the Covid-19 pandemic I decided to switch to open book exams instead of using the UNL Exam Commons to conduct proctored exams. The exams had a time limit—60 minutes for 50 questions—and questions needed to be answered in order.

Over the course of the semester the grade distribution shifted. While 22 of 36 students scored in the A and B range for exam 1, 29 achieved an A or B on the final exam. More importantly, the number of students scoring below a C fell from 7 to 3 students.

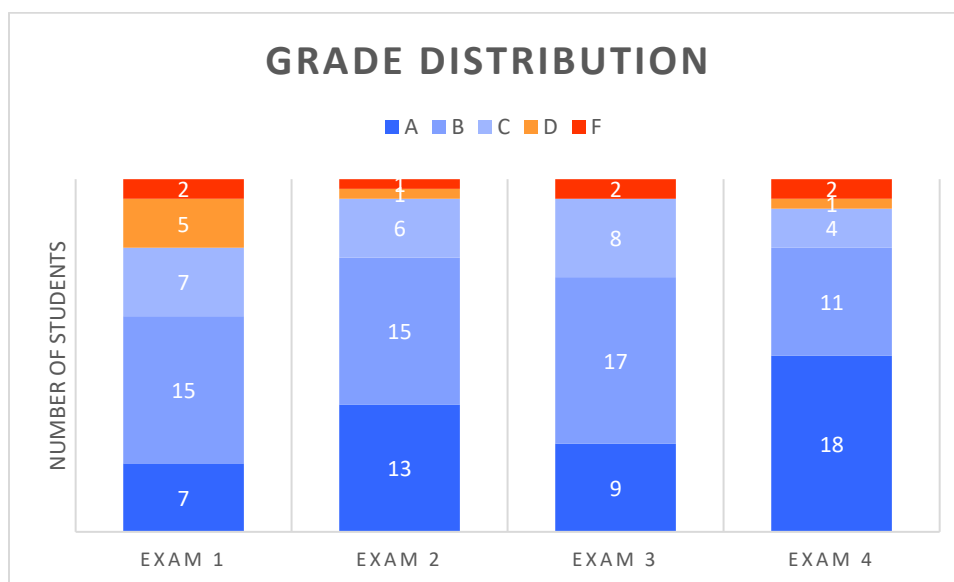


Figure 1. Exam score distribution (A ≥ 90%, B 80 - <90%, C 70 - <80%, D 60 - <70%, F <60)

The median exam score increased from exam 1 to exam 2 to exam 4 from 85 % to 88 % to 91 %. The median for exam 3 was 85 %. Students perceived exam 3 content as more difficult than exam 1 and 2.

In addition to the overall improvement another interesting development was happening. The distribution of the individual exam scores changed. Improvements were slightly more pronounced in

quartile 1 than quartile 3 and the number of students with a failing grade on the exams (< 72 %) declined.

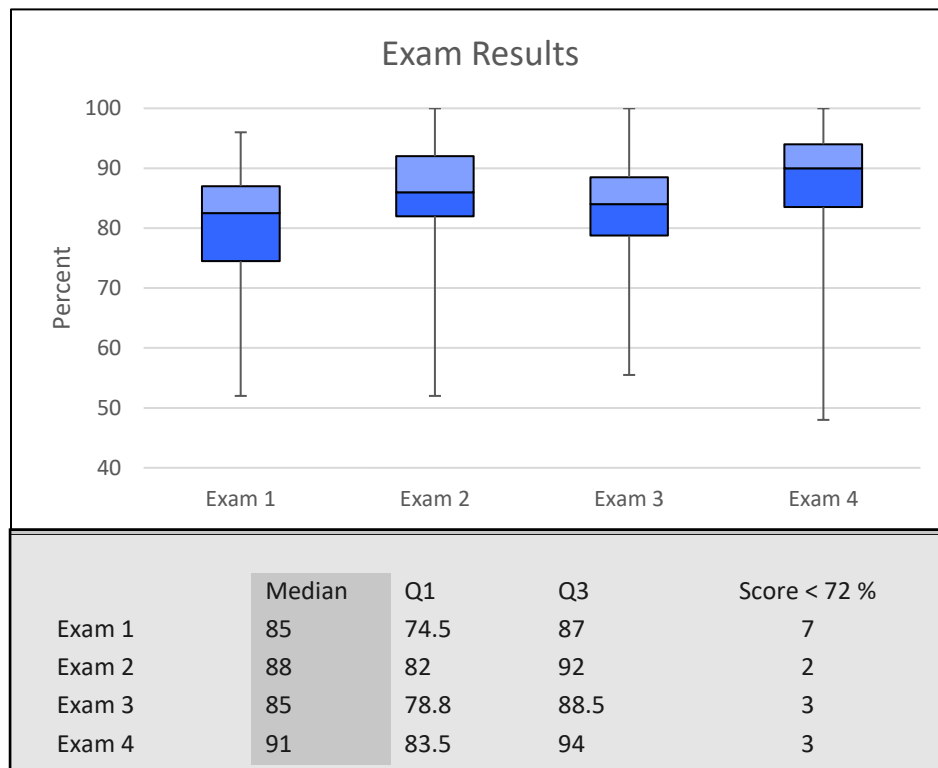


Figure 2. Exam score development (n=26, median, quartile 1 and quartile 3).

3.1.2 Learning develops differently in high and low-achieving students

When exam medians improve, we can assume that learning takes place. The questions is who is learning and who is not since a median increase does not necessarily reflect that all students in a course are thriving.

Students come into a course with varying knowledge, study techniques, and the ability and desire to engage in the course. For this analysis the assumption was made that the first exam tends to reflect this difference.

Therefore, students were split into four quartiles according to the exam 1 score.

	Exam 1 (%)	n
Quartile 1	52 – 74.5	10
Quartile 2	74.5 – 85	9
Quartile 3	85 – 88.5	8
Quartile 4	88.5 – 96	9

Tracking the four median exam scores made it clear that learning took place in all quartiles. The data visualized two trends:

1. Learning tools affects lower achievement quartiles the most. This is especially visible in quartile 1 and 2 where half of the students improved a full grade or more. This improvement is not as pronounced in the upper quartiles.
2. Looking at individual student learning development, fluctuations between exams are larger in the two lower quartiles. Students who scored low on exam 1 can improve, but it seems more difficult for them to maintain the higher level of learning.

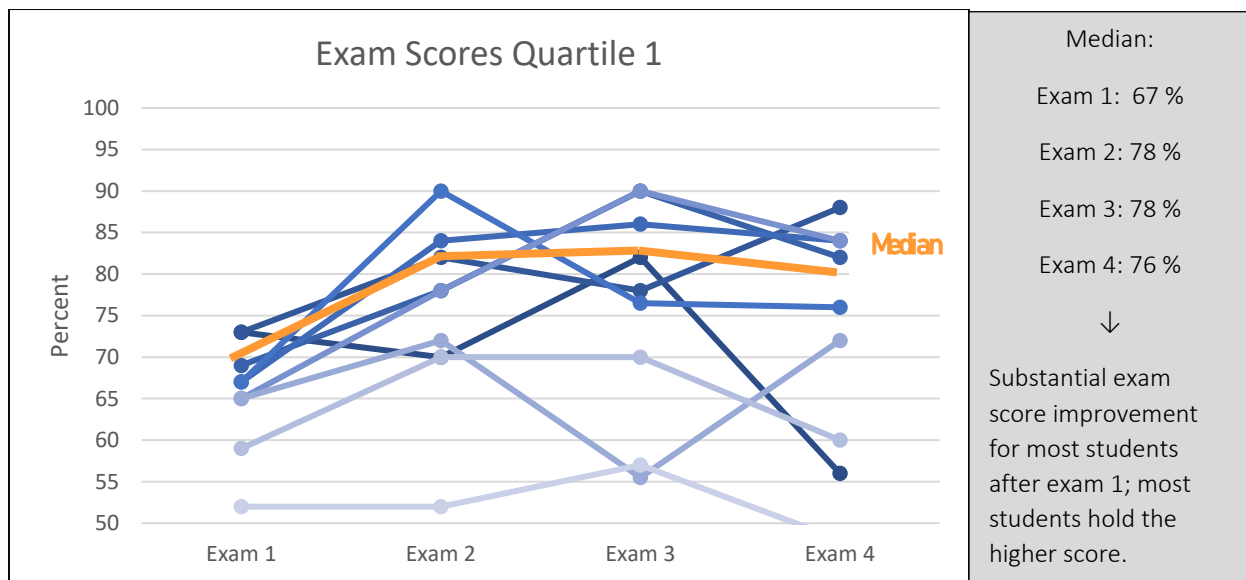


Figure 3. Exam score development stratified by exam 1 quartiles: Quartile 1.

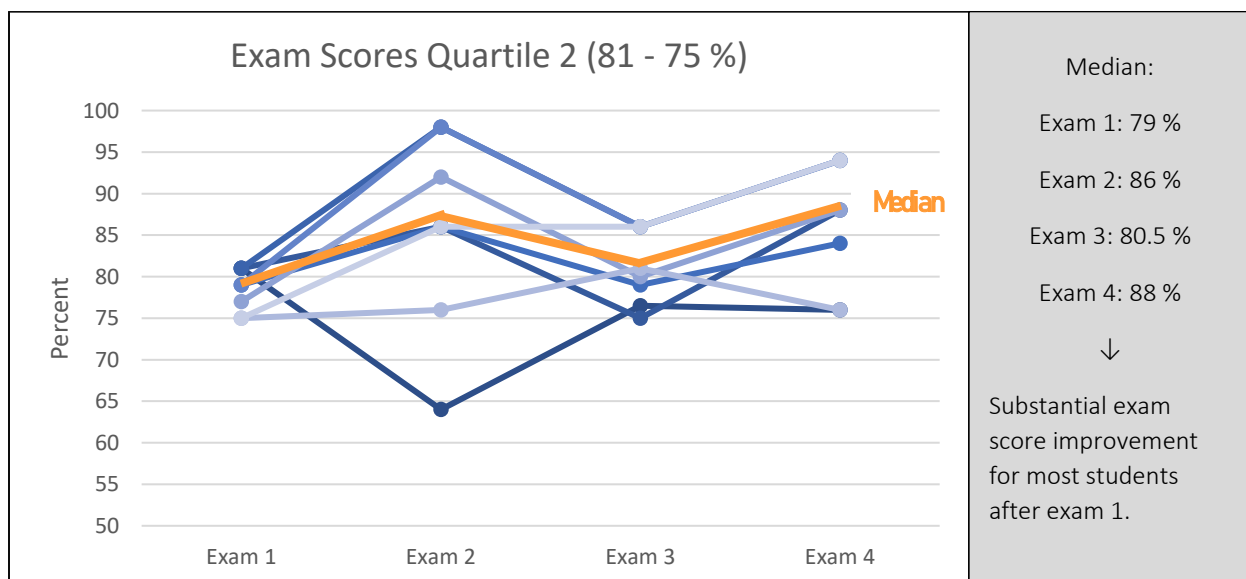


Figure 4. Exam score development stratified by exam 1 quartiles: Quartile 2.

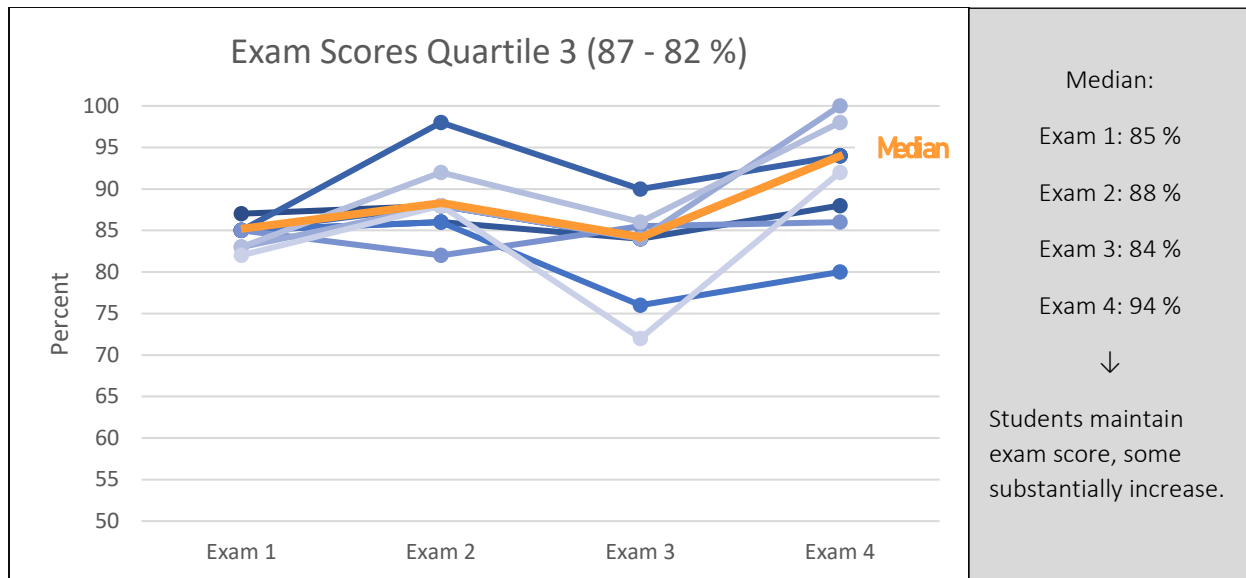


Figure 5. Exam score development stratified by exam 1 quartiles: Quartile 3.

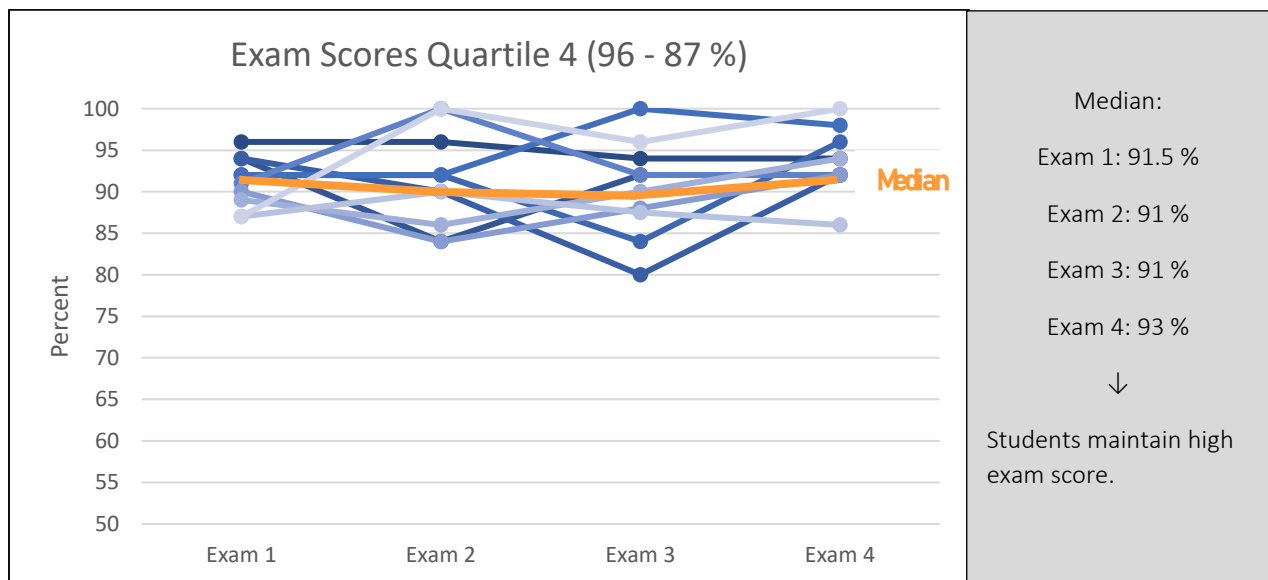


Figure 6. Exam score development stratified by exam 1 quartiles: Quartile 4.

3.1.3 Engagement with learning tools predicts average exam scores

A learning tool can only be effective if students are using it. This raises the question if lower achieving students are sufficiently engaged in the course and are using the learning tools fully.

An engagement score was calculated by averaging the final score for study quizzes and activities. Both, study quizzes and activities are employed with the intend to improve understanding of the learned concepts. Students are encouraged to ask for instructor help and learn from other students. Therefore, these scores do not assess learning but reflect participation and engagement in the course.

Plotting the engagement scores against the exam scores it becomes clear that engagement in the course by using the learning tools offered is strongly correlated to exam success.

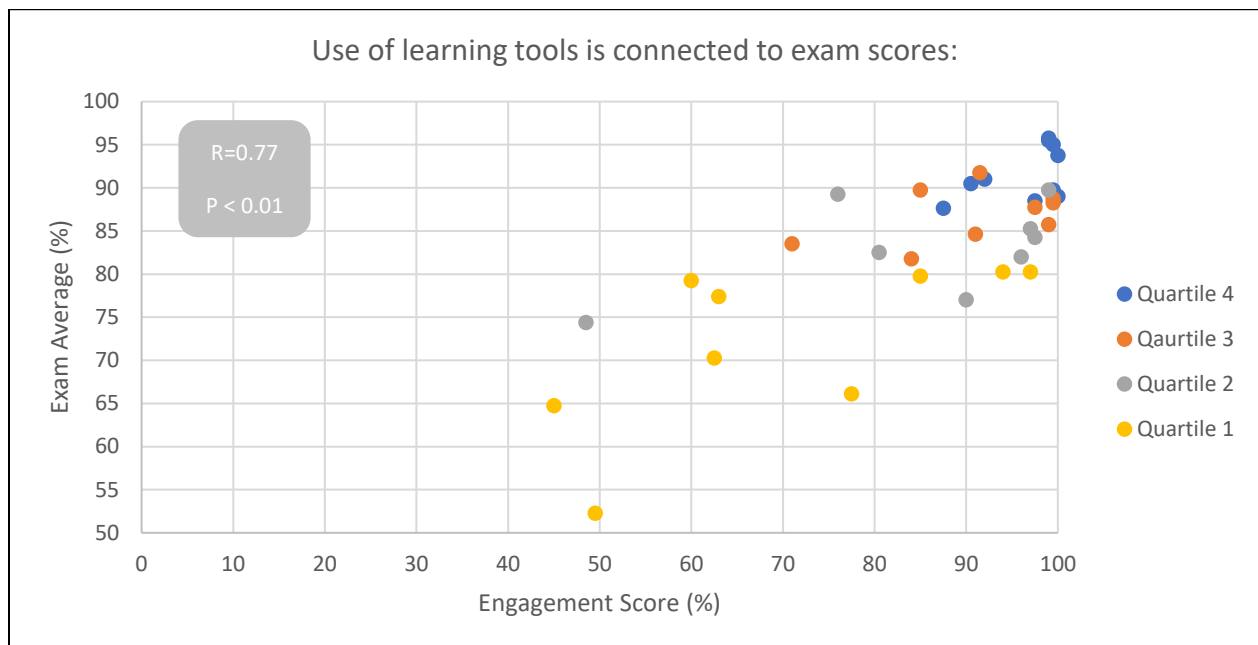


Figure 7. Engagement score (average of final study quiz and activity score) plotted against exam average; Pearson Correlation Coefficient.

3.2 Evaluate the efficiency of employed learning tools in aiding conceptual learning (student perception).

Exam and quiz scores depict how well students reach the set objectives. Based on those grades we often assume that the learning tools we deploy in a course are working.

High achieving students tend to be successful learners with or without the help of learning tools. Lower achieving students profit much more by guided learning. My goal is to offer a sufficient variety of learning tools that enables all students to thrive without creating busy work. This includes challenging high achieving learners and supporting the learning of lower achieving learners in the course.

Therefore, student surveys are essential to complete the picture by exploring the student point of view.

After each exam I asked the students to complete a survey evaluating the learning tools. Almost all students who signed the informed consent completed survey 1 and 2. Survey 1 and 2 results were similar, and I ended up pooling the two surveys.

The survey after exam 3 focused on the open educational resource (OER) and is not included in this portfolio.

Survey 4 was deployed before the final exam and I would have liked to compare the end of the semester experience with the first half of the semester, but only a small number of students was willing to complete the last survey in this busy time of the semester.

The learning tools I evaluated for the portfolio are:

- Multi-answer study quizzes
- Problem-solving activities
- Infographics
- Comprehension questions
- Collaborative study guide writing (self-explanation)

3.2.1 Study quizzes aid understanding of the concepts

At the end of each module section the students completed a 10-point study quiz. The questions have a multi-answer format. The number of correct answers is unknown and students have three attempts to complete the quiz. The goal for this tool is to identify areas in need of additional work and improve conceptual understanding.

Almost all students reported that the study quizzes are successful in reaching this goal. 56 % of the students reported that the study quizzes helped a lot.

After stratifying the responses into the for exam 1 quartiles, it became clear that the higher achieving students appreciated the study quizzes more than lower achieving students. All students in quartiles 2, 3 and 4 felt that the study quizzes aided their learning at least somewhat. Quartile 1 students seemed not as convinced.

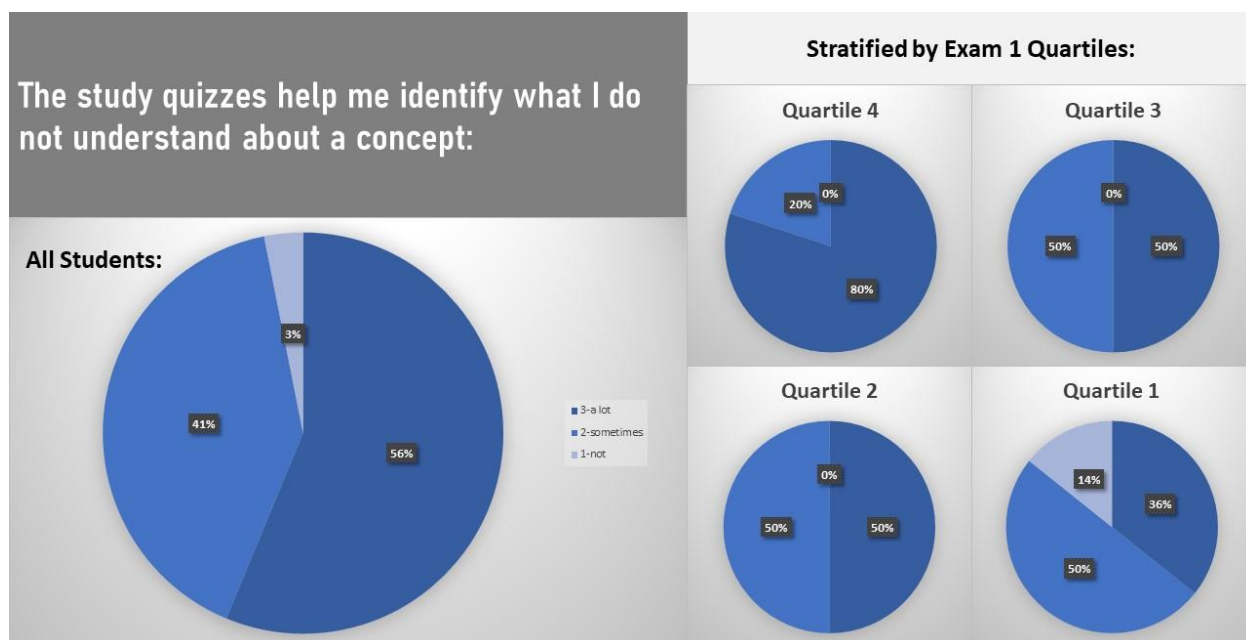


Figure 8. Pooled responses from post exam 1 and post exam 2 surveys: The study quizzes helped me identify what I do not understand about a concept.

Students were also encouraged to share their perception of the learning tools and how they use tools. Here are some selected responses:

"I enjoyed the unlimited time to take the quizzes and that we got several chances. It made me feel like I was actually learning the material and not just trying to pass a class."

"I think the opportunity to have three attempts on the quizzes is very helpful because it gives you the chance to see what you don't understand and gives you opportunities to improve upon your prior knowledge."

"I think that the quizzes are difficult, but they help me realize what concepts I need to study more."

3.2.2 Problem-solving activities can be useful, but need re-designing

At the end of most chapters students participated in a collaborative problem-solving activity applying the chapter concepts to a common misconception, case example, or food application question. The goal was to connect the learned concept to eating and therefore deepen the understanding of the concept.

Based on conversations and survey results after exam 1 and 2 I started redesigning the activities during the semester.

- The activities morphed from broad application to very specific current, real-life questions.
- Collaboration became optional.
- Instruction guided students to first recall the concept and then apply.

- The activity received engagement points and instructor feedback.

While students were not fully convinced that the activities aided their learning at the beginning of the semester oral feedback became more positive at the end of the semester as I found a format that students appreciated. The following student comment sums it up. *“Though the activities were a bit of a pain to complete (they required a lot of thinking and application) I found that they actually really helped me apply what we were learning. It forced me to take a deep dive into what we're learning and apply it.”*

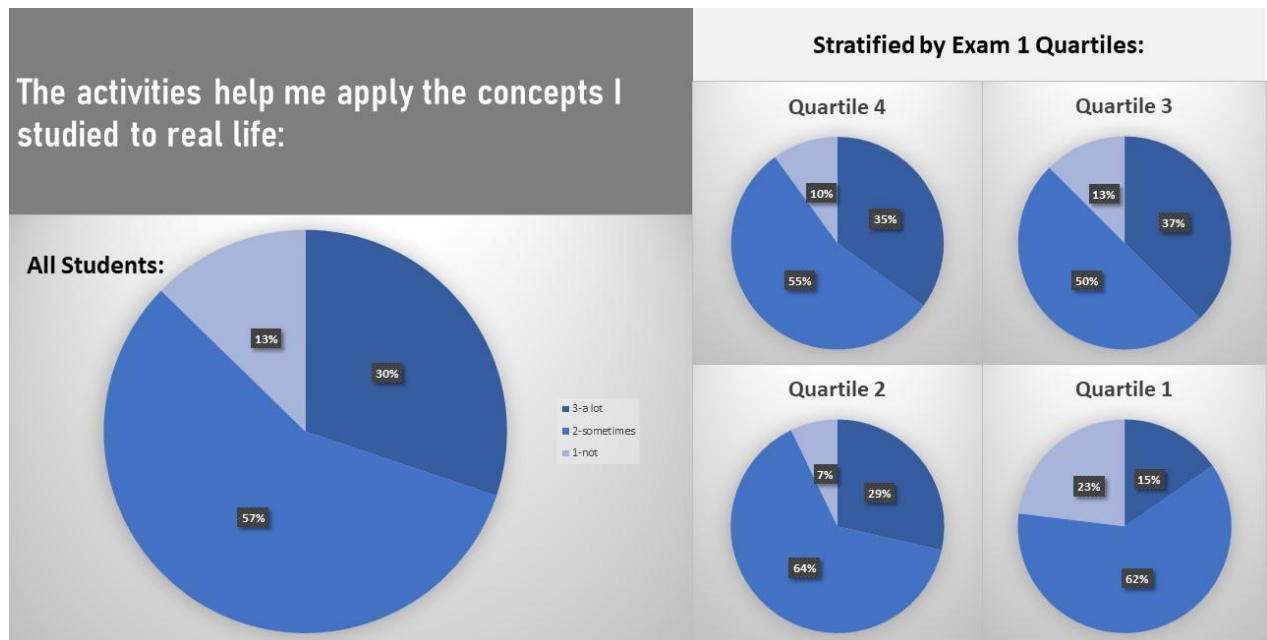


Figure 9. Pooled responses from post exam 1 and post exam 2 surveys: activities help me apply the concepts I studied to real life.

“It was helpful to have the real-life applications mixed into the information. I feel like a lot of classes will throw information out then relate everything at one time, but the step by step of this course is helpful.”

“I really liked the google slides homework activities because they gave me a chance to explain what we were learning in class but in my own words. I think being able to give my input on a controversial or confusing topic is good practice for me.”

3.2.3 Infographics are an effective learning tool to identify and understand concepts

Concepts are summarized using infographics which are used as a visual support during the lecturing phase of a class (I added animations to develop a concept). The infographics are also included in the course OER (open educational resource).

Students clearly think that the infographics allow them to identify the concepts introduced and aid understanding of concepts. This learning tool is not as appreciated by students who scored in the first quartile of exam 1.

In a separate survey (not included here) students reported the infographics aid identifying concepts and understanding. The students also reported that the infographics have a second purpose, reviewing concepts and looking up facts quickly.

Students suggested while the infographics are very useful, they could be more intuitive.

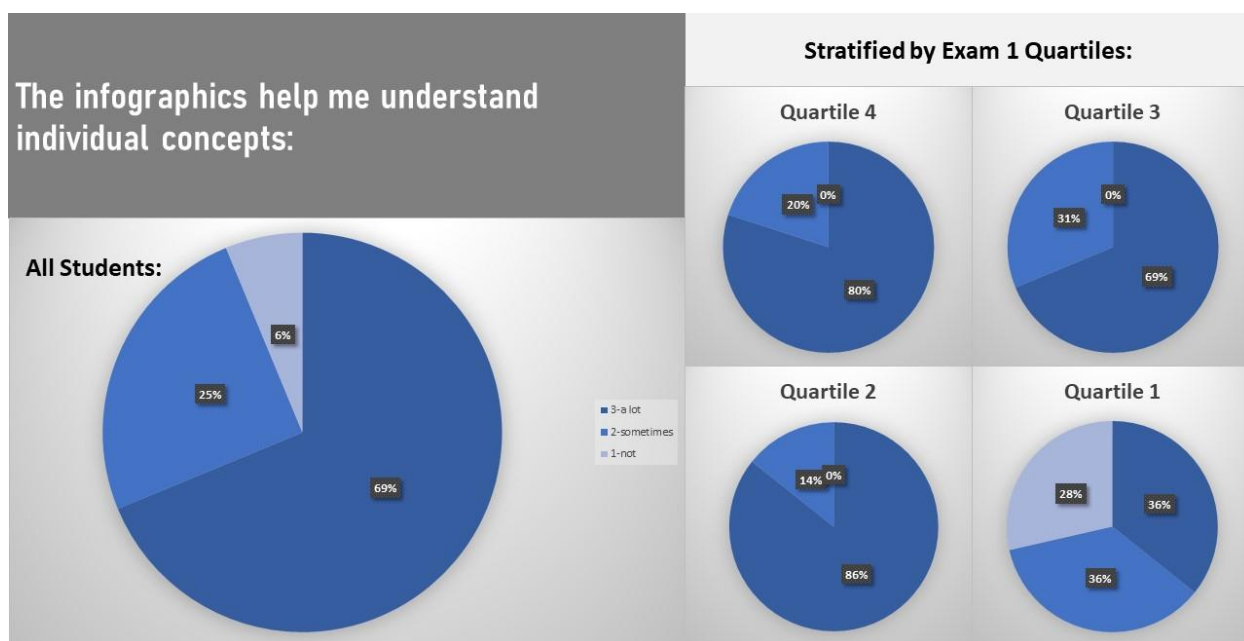


Figure 10. Pooled responses from post exam 1 and post exam 2 surveys: The infographics help me understand individual concepts.

"I really like the infographics. They helped compact a concept into one area where I could easily go to. It simplified the concept and helped me understand the overall process."

3.2.4 Comprehension questions help staying focused during lectures

During the lecture phase of each class, I added survey style comprehension questions. The questions either recalled knowledge from previous courses necessary to understand the newly introduced concept or tested comprehension.

The consensus across all quartiles was that comprehension questions during the class improve understanding and help maintain focus. Students suggested to incorporate more questions.

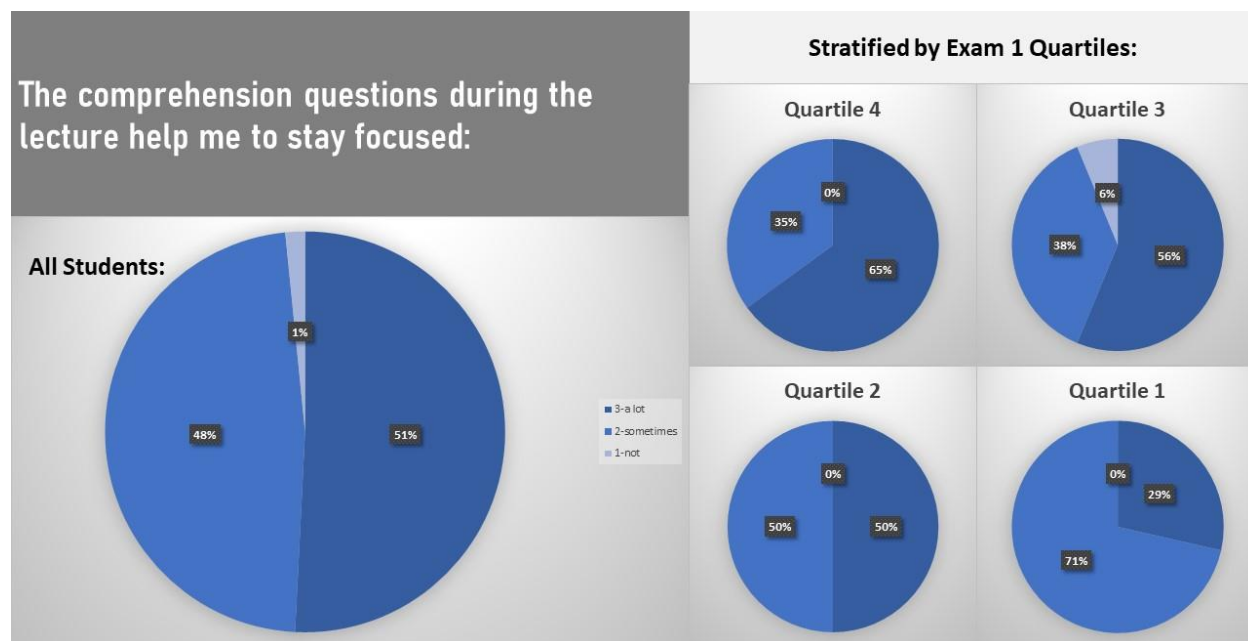


Figure 11. Pooled responses from post exam 1 and post exam 2 surveys: The comprehension questions during the lectures help me to stay focused.

"I really liked the comprehension questions during lecture. Having those questions really help me stay focused and understand the material better. I think it would be better to have more of the questions throughout the lecture."

"I like the questions that are asked during class. I would like if there were more questions, maybe one questions every 20 mins. They help me stay focused and aware of what I am learning."

3.2.5 Collaborative self-explanation works well in-person, but not in a zoom or online setting

I reserved one class before each exam as a study guide class. I generated a Google Doc for each chapter in the module and added the infographics with corresponding application/concept questions. This set of documents was shared with students. During the class students assigned themselves to groups and collaboratively completed the study guide. In addition, students edited content other groups wrote and developed multiple choice study questions and answers.

The response from students was mixed. While some liked the collaborative aspect of the study guide writing, others did not. This was surprising because during the spring 2020 face-to-face course students loved the collaborative aspect of the study guide. Students actively discussed the concepts and agreed that hearing a different view from other students deepened their understanding.

While students thought that the study guide was helpful on its own, they questioned the effectiveness of the collaboration aspect in a zoom setting. I ended up giving students two options: Work with a group of their choosing or work alone and add their contributions later to the study guide. One student remarked that he was surprised that adding his work to the collaborative study guide also aided his learning.

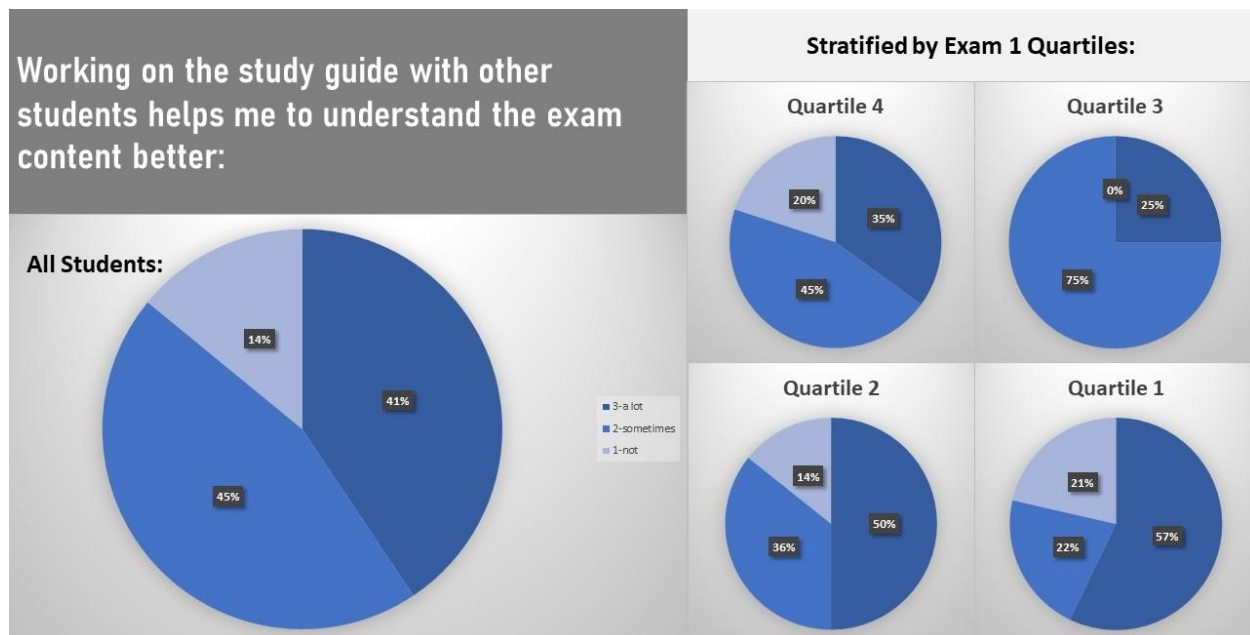


Figure 12. Pooled responses from post exam 1 and post exam 2 surveys: Working on the study guide with other students helps me to understand the exam content better.

“The study guide starts as a good idea, but when we go to do it, especially on zoom, it gets complicated. The google docs are quite long, and it is difficult to collaborate with.”

“I thought the study guide was most helpful to summarize all information and infographics and see how it all comes together and is related to one another. Having it all in one place is helpful for studying for the exam.”

“The study guide was the most helpful because I got to read the concept reworded by other students which helped me understand the material a bit more.”

Overall Evaluation:

Lastly, I asked students how the learning tools contributed to their learning. Students were instructed to check all that apply. Almost all students reported that the learning tools helped their understanding of concepts.

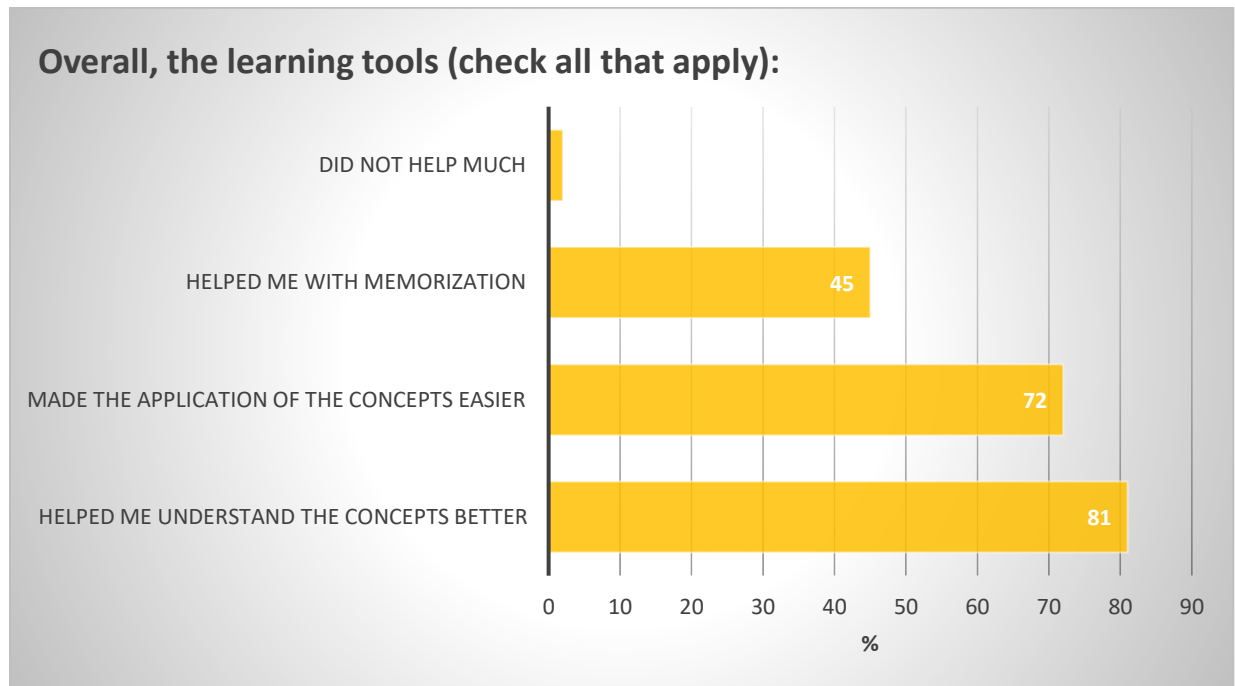


Figure 13. Pooled responses from post exam 1 and post exam 2 surveys: Student perceived function of learning tools

"I got a better understanding of connecting concepts and seeing how they relate/effect one another and people in the real world. I also learned some new eating habits in my personal life that have been beneficial."

"I enjoyed this class and I enjoyed working in groups with my classmates. On top of all the nutrition knowledge I gained, I also got to practice my communication skills with others. I think I improved with being more patient with myself and taking more time to read."

"Overall this class taught me a substantial amount."

4. Going Forward

The analysis of student learning included gauging how well students reached learning objectives and then added the student view of learning. Overall, the data and comments showed that the course is well-designed and improves conceptual learning. The data and comments also pointed out areas that need more course design work:

1. The combination of learning tools was effective in aiding conceptual learning. Students kept improving on answering conceptual and application questions on the exams. This is reflected in the development of exam grades during the semester and the student feedback. The same trend was also visible subjectively in the quality of problem-solving activity responses.
2. Higher achieving students appreciated all learning tools. Students who tested in the first quartile for exam 1 felt less that the learning tools employed in this course benefited their learning with one exception. The learning tool they responded more positively to than the other quartiles was the study guide. Despite the lower appreciation for the learning tools student testing in the lowest quartile during exam 1 improved the most by a full grade.
3. As many studies showed before, engagement in the course is of course key to success.

The surveys also pointed out the areas that need improvement. Over the next semesters I will keep collecting student feedback and tweak the learning tools to make them even more intentional.

The **infographics**, used as lecture visual aids and in the open educational resource, are working as intended. Infographics help arrange content of a class into concepts and summarize those concepts. Adding animations during lectures, the students can see the development of a concept. This approach helps students to focus first on the big picture and understand how concepts are interrelated. Memorizing facts follows understanding.

Designing infographics of complex scientific concepts is not easy. Infographics need to be self-explanatory and balance informational depth with visual clarity. Otherwise, students feel overwhelmed by the complexity of the infographic. Students pointed out that some of the more complex infographics could be more intuitive. I have a seed grant that will allow me to hire student workers studying public relations and design. I plan on hiring two students over the summer or during fall semester who will help redesign the infographics.

The results of the first survey showed that the **problem-solving activities** were not effective in supporting the real-life application of the learned concepts. Throughout the semester I already tried out different formats for those activities and towards the end of the semester I found a format that seems to be effective in enhancing conceptual learning. The activities focus now on a narrow practical and current question. I also redesigned the activity so it automatically walks students through the process of recalling the concept, self-explaining the concept and finally applying the concept. I intend to redesign all activities that way and then start the survey process over.

The surprise result for me was the response to the **collaborative study guide writing activity**. It seems that the collaborative aspect that worked so well in an in-person course—the six students attending the course in person this semester also loved it—cannot be replicated in a zoom setting. I will teach the

course in fall 2021 for the first time online and it will be interesting to see how the study guide writing activity will work.

During the next semester I plan to go one step further. Instructional design knowledge suggests that retention of content increases with engagement and conceptual learning. Cognitive research shows that our brain is not set up to memorize disjointed facts. The process of deciphering the components of an infographic enhances conceptual learning and forms a knowledge base. Facts and details can be attached to the concept during the process of memorization.

In addition, deciphering the components of an infographic will also slow down learning. This slowing down of learning and the engagement with the content has the potential to aid retention as well. In future semesters I intend to explore the question if conceptual and application learning fostered in NUTR251 will also enhance long-term retention of the learned content.

The peer review project sharpened my skills in deploying learning tools very intuitively. My course design approach was always student driven.

Over the 20 years I design and teach courses I saw student needs change profoundly. This was in part driven by technology, but not exclusively. Today's students expect interesting, novel content delivered in a way that is engaging and support their learning. On the other hand, students also expect that instructors are respectful of their time and that learning is effective. Many students need to be coaxed into in-depth learning.

This experience informs how I design and teach courses today. I determine the content and learning objectives that are essential for other courses and the students' professional carrier after graduation. How this content and learning is delivered depends on my conversations with students.

Before participating in this project, choosing learning tools was based on my teaching experience combined with a trial-and-error approach of evaluation. This evaluation happened by gauging the average achievement of learning objectives and during conversations with students. Often ideas for better use of learning tools and new ideas for solving issues came directly from the students. The drawback was that students I had those constructive conversations with were mostly highly engaged and achieving students.

During the peer review of teaching project I added an additional component to my course design toolbox: Data driven evaluation.

The data supported my approach—this is good to see—but more so gave me a more nuanced evaluation of my course design. Especially the stratified student surveys and analysis of the exams opened my eyes to the different needs of individual students. This insight will allow me to work on designing learning tools that work for students of all levels of achievement.

I'm especially pleased that many students who scored in quartile 1 of the first exam were able to improve substantially, some students up to two letter grades, throughout the semester and very few students scored under 72 % on exams.

My experience of the last three semesters re-thinking a traditional staple course in nutrition sciences taught me that today's students appreciate interesting, stimulating content that connects back to their

life experience. The peer review project started me on taking a data driven approach evaluating my courses.

5. Appendix: Syllabus

Nutrition Through the Lifecycle

Nutrition 251

Nutrition and Health Sciences
3 Credit Hours

Instructor: Sabine Zempleni, M.S.

E-mail: szempleni2@unl.edu

Phone: 402-472-6879

Office hours:

- Before and after class or by scheduled zoom meeting
- Personal questions can also be submitted by e-mail. Most of the time I will answer e-mails promptly Monday through Friday 9 – 12 a.m. Please add the course number [NUTR 251] to your subject line. I'm teaching 5 courses and almost 200 students.

Covid-19 Safety

FACE COVERINGS SYLLABUS STATEMENT Approved by the Faculty Senate Executive Committee July 14, 2020 Required Use of Face Coverings for On-Campus Shared Learning Environments*

As of July 17, 2020 and until further notice, all University of Nebraska–Lincoln (UNL) faculty, staff, students, and visitors (including contractors, service providers, and others) are required to use a facial covering at all times when indoors except under specific conditions outlined in the COVID 19 face covering policy found at: <https://covid19.unl.edu/face-covering-policy>.

This statement is meant to clarify classroom policies for face coverings: To protect the health and well-being of the University and wider community, UNL has implemented a policy requiring all people, including students, faculty, and staff, to wear a face covering that covers the mouth and nose while on campus.

The classroom is a community, and as a community, we seek to maintain the health and safety of all members by wearing face coverings when in the classroom. Failure to comply with this policy is interpreted as a disruption of the classroom and may be a violation of UNL's Student Code of Conduct.

Individuals who have health or medical reasons for not wearing face coverings should work with the Office of Services for Students with Disabilities (for students) or the Office of Faculty/Staff Disability Services (for faculty and staff) to establish accommodations to address the health concern. Students who prefer not to wear a face covering should work with their advisor to arrange a fully online course schedule that does not require their presence on campus.

Students in the classroom:

1. If a student is not properly wearing a face covering, the instructor will remind the student of the policy and ask them to comply with it.
2. If the student will not comply with the face covering policy, the instructor will ask the student to leave the classroom, and the student may only return when they are properly wearing a face covering.
3. If the student refuses to properly wear a face covering or leave the classroom, the instructor will dismiss the class and will report the student to Student Conduct & Community Standards for misconduct, where the student will be subject to disciplinary action.

Instructors in the classroom:

1. If an instructor is not properly wearing a face covering, students will remind the instructor of the policy and ask them to comply with it.
2. If an instructor will not properly wear a face covering, students may leave the classroom and should report the misconduct to the department chair or via the TIPS system for disciplinary action through faculty governance processes.

*Courses that have been granted an exception to the Face Covering Policy for pedagogical reasons are excluded. Exceptions to the Face Covering Policy are only granted after an approved health safety plan is developed.

Student Resource Statement

The University of Nebraska-Lincoln and the College of Education and Human Sciences are committed to ensuring the health and well-being of our students. This responsibility is shared by all members of the academic community and includes providing resources for the intellectual, academic, financial, physical, social and mental well-being. To further this, the College of Education and Human Sciences has developed a comprehensive resource guide that has been developed to assist faculty and students in finding specific university and CEHS resources based on their needs. This can be found at go.unl.edu/studentresources.

Course Description and Goals

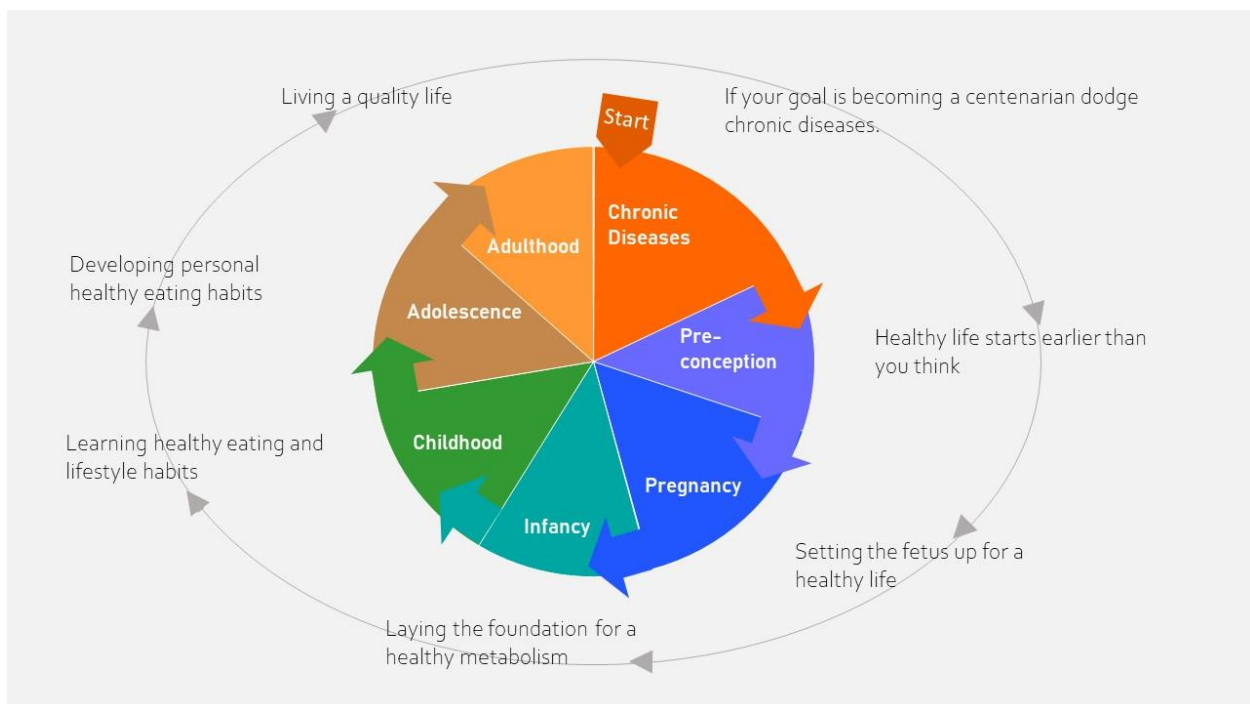
Quality of life and healthy life expectancy depend on avoiding or delaying chronic diseases during life. Lifestyle choices during all life stages, especially the critical periods, prime the individual for the development of chronic diseases.

Eating is not a one-size fits all approach. Personal preferences, culture, income, food availability, food knowledge, age, and many other factors influence the food and eating choices we make. While humans can thrive on a variety of eating patterns not all are ideal. Some are detrimental to our long-term health.

In NUTR250 *Human Nutrition and Metabolism* you learned the corner posts of nutrition knowledge. You discussed all nutrients and their food sources, recommended amounts and their metabolism. *Nutrition Through the Lifecycle* will build on this knowledge and expand it.

In this course you will study how human physiology and metabolism change throughout life and how eating should adjust to it. You will also understand how malnutrition in all life stages profoundly impacts quantity and quality of life.

This will allow you to understand professional recommendations and health policy for major life stages, but also will allow you to make better, individualized recommendations as a future health professional.



Upon completion of this course you will be able to:

- Explain how physiological changes during life alter dietary needs.
- Recognize health consequences of malnutrition during critical life-stages.
- Explain the rationale for major public nutrition interventions.
- Identify some socio-economic and cultural barriers to meet nutritional needs.

Exam 1

2/13

-

2/15

Module 1: Development of Chronic Diseases

If your goal is becoming a centenarian dodge chronic diseases: The development of obesity and the connection to T2D, hypertension and CVD.



Exam 2

3/9

-

3/11

Module 2: A Healthy Life Starts Earlier Than You Think – Preconception and Pregnancy

What can prospective parents do to successfully conceive and prepare for a healthy pregnancy? How do physiological changes during pregnancy and fetal nutrient needs alter the mother's nutritional needs? How can eating promote a healthy pregnancy and set up the fetus for a healthy life?



Exam 3

3/30
-
4/1

Module 3: Setting Up a Healthy Metabolism - Infancy to Preschool Age

What is the best nutrition during the first year of life to ensure optimal growth and promote a healthy metabolism? How do early feeding choices promote lifelong health? How do children develop an eating pattern? How can parents and daycare provider help to make it a healthy one?

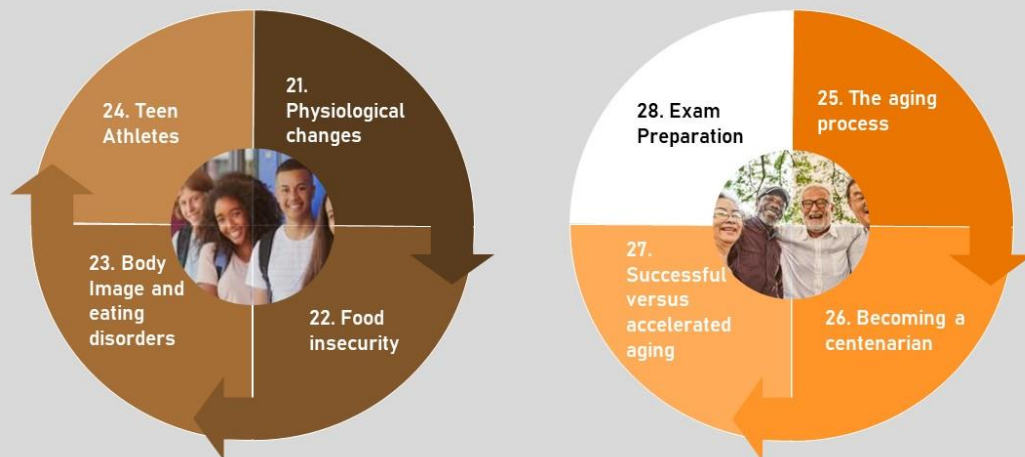


Exam 4

5/1
-
5/4

Module 4: Developing and Maintaining Healthy Eating Habits – School Age, Adolescence, Adulthood

How can we enable school children and adolescents to find their own healthy eating pattern? How does the aging process impact health, nutrient needs and eating during adulthood? Can a healthy diet and lifestyle postpone common conditions of old age?



Course Materials

This course will use a free open educational resource (OER) instead of a printed textbook. The chapters will be linked in Canvas and can be printed as a PDF if you prefer.

Additional resources will be made available as needed.

Course Communication

Communication is important to me. If you have questions, struggle with the class, would like to share information you read in the media, I would like to know and talk about it.

The format of this course is conceptual. This means that I test understanding of the concepts. If you find that you struggle with this learning approach come and see me. I can explain concepts as needed again and we can talk about study strategies.

During this time of social distancing the way we communicate changed. You can always talk to me before, during, or after class. You can also schedule a zoom meeting.

I will answer emails in the morning and make it a priority to answer your emails during the work week the next day at the latest.

If I forget to answer your email—this might happen if I read your email on the phone, don't have the resources to answer it right away, and a lot of other things coming up—feel free to email me again. This is not a bother.

Evaluation

	Number	Points	Total Points
Exams	4	100	400
Quizzes	10	10	100
Class Activities	TBA	TBA	50
Extra Credit	Varies	1	Varies
Total	500		

Exams—400 Points:

The exams are traditional closed-book exams including multiple choice and true/false questions. Correct answers are worth 2 points. You will take the exams at the Exam Commons.

Quizzes—100 Points:

There will be eight Canvas based, open-book quizzes which will include multi answer, and true/false style questions. You will have three attempts to complete each quiz before the indicated due date. After the due date the quiz will be no longer available on Canvas and points will be entered as 0 if no attempt was made.

Class Activities—50 Points:

Class activities will help you gain a deeper understanding of the content. For most activities you will work in groups during the class time. Some of the activities your team will need to complete outside of the classroom.

Extra Credit:

Throughout the semester you will be able to collect up to 10 extra credit points by participating in the Yellowdig board. You will collect and discuss interesting scientific information relating to the ongoing modules.

Late work will be subjected to a 10% deduction per day.

GRADING SCALE FOR THE COURSE

97.51 – 100 %	A+
92.51 – 97.5%	A
89.51 – 92.5	A-
87.51 - 89.5 %	B+
82.51 – 87.5 %	B
79.51 – 82.5 %	B-
77.51 – 79.5 %	C+
72.51 – 77.5 %	C
69.51 – 72.5 %	C-
67.51 - 69.5 %	D+
62.51 – 67.5 %	D
59.51 – 62.5 %	D-
0 – 59.5 %	F

Students must earn a C or above in NUTR 251 to meet graduation requirements.

What Is Expected?

COVID-19 adjustments: If you are not able to participate in class due to health concerns you need to participate via zoom. Students coming to class must wear a face mask and adhere to social distancing.

Success in this course will rely on engagement and participation.

Workload will vary depending on the knowledge you bring into the course from NUTR250 *Human Nutrition and Metabolism*. Reviewing and re-studying NUTR250 content as needed will be expected.

Generally, I design a 3-credit course with a weekly time commitment of 6 hours in mind as UNL guidance suggests.

Classes

Since the readings supplement the lectures you will need to come to class and take notes. If you miss a class, it will be your responsibility to get notes from other students and work through the activities at home.

You will need to bring a laptop for in class activities.

Before exams there will be an exam preparation class. During this class we will review exam content and collaboratively pool notes and develop a study guide.

Before you come to class:

Download the infographics for easier note taking.

During class:

- Participate in skill building activities and class discussions.
- Take notes. The infographics will give you an outline of the concept, but you need to fill in the details.
- Ask questions! Make sure your notes are precise and correct.

After class:

- Complete the reading and go over your notes. Bring them into a format that will allow you to study for the exam. Make sure you understand the concepts. If you have questions email me the question before the next class.
- At the end of the module take the post-quiz.

THE SYLLABUS IS SUBJECT TO CHANGE IF DETERMINED TO BE NECESSARY BY THE INSTRUCTOR.

Statement of Academic Integrity

<http://stuafs.unl.edu/ja/code/three.shtml>

“Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty.”

Diversity Statement

“The University of Nebraska-Lincoln is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity. We assure reasonable accommodation under the Americans with Disabilities Act. Students with disabilities are encouraged to contact me for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, student must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.”